(6) $y = \tan(3x)$

$y' = \sec^2(3x)(3)$

$= 3\sec^2(3x) = \dfrac{3}{\cos^2(3x)}$

(7) $y = \cos\left(\frac{1}{2}x\right) + \sin(4x)$

$y' = -\sin\left(\frac{1}{2}x\right)\left(\frac{1}{2}\right) + \cos(4x)(4)$

$= -\frac{1}{2}\sin\left(\frac{1}{2}x\right) + 4\cos(4x)$

(11) a) $\frac{d}{dx}\tan(x^3) = \sec^2(x^3)(3x^2)$

$= 3x^2\sec^2(x^3)$ or $\frac{3x^2}{\cos^2(x^3)}$

b) $\frac{d}{dx}\cos^4(x) = 4\cos^3(x)$

(12) a) $\frac{dy}{dx}(\sin(3x-4)) = \cos(3x-4)(3)$

$= 3\cos(3x-4)$

b) $\frac{d^2y}{dx^2} = -3\sin(3x-4)(3)$

$= -9\sin(3x-4)$

y''

$\sin(2x)\cos(x)$

more examples

Ex Find the equations of the tangent line and normal line to the curve $f(x)=\cos(3x)$ at the point where $x=\frac{\pi}{9}$.

$f\left(\frac{\pi}{9}\right)=\cos\left(3\cdot\frac{\pi}{9}\right)$
$=\cos\left(\frac{\pi}{3}\right)=\frac{1}{2}$

RECALL: to find the equation of a tangent line at $x = \underline{a}$, $a \in \mathbb{R}$

1) find the slope of that line by taking the derivative (since the derivative is the slope of the tangent line!!)
2) plug the x-value of the point given into the derivative to find the gradient (m=slope).
3) use point slope to find equation for normal line, take $-\frac{1}{m}$

$y-y_1=m(x-x_1)$

$f'(x)=-\sin(3x)(3)=-3\sin(3x)$

$f'\left(\frac{\pi}{9}\right)=-\sin\left(\frac{3\pi}{9}\right)(3)=-3\sin\left(\frac{\pi}{3}\right)=\frac{-3\sqrt{3}}{2}$

tangent line: $y-\frac{1}{2}=\frac{-3\sqrt{3}}{2}\left(x-\frac{\pi}{9}\right)$

normal: $y-\frac{1}{2}=\frac{2}{3\sqrt{3}}\left(x-\frac{\pi}{9}\right)$

Some more examples ☺

Find the derivative of

CHAIN RULE

a) $f(x) = 4e^{2x} + \sin(3x+2)$

$f'(x) = 4e^{2x}(2) + \cos(3x+2)(3)$

$= 8e^{2x} + 3\cos(3x+2)$

b) $e^x \sin x$

Product Rule

$\frac{d}{dx} = e^x(\cos(x)) + e^x \sin(x)$

c) $y = \cos^3(x)\sin(x)$

Product and ~~Quotient~~ Power

$y' = \cos^3(x)\cos(x) + 3(\cos^2(x))(-\sin(x))\sin(x)$

$= \cos^4(x) - 3\sin^2(x)\cos^2(x)$

d) $s(t) = \ln(\sin t)$

Chain

$$s'(t) = \frac{1}{\sin(t)} \cos(t) = \frac{\cos(t)}{\sin(t)} = \cot(t)$$

HW 14B, p. 499 # 2-4

14C p. 501 # 1-11 odd, 12